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NATIONAL DAM SAFETY PROGRAM. SPRINGHI LAKE DAM (INVENTORY NUM--ETC(U)
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20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam and appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the design flood should not be interpreted as necessarily posing a highly inadequate condition. The design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Springhill Lake Dam
State: Virginia
County: Bedford
USGS 7.5 Minute Quadrangle: Peaks of Otter, Virginia
Stream: Unnamed Tributary to the Big Otter River
Date of Inspection: 5 June 1979

BRIEF ASSESSMENT OF DAM

Springhill Lake Dam (formerly Toms Dam) is an earthfill embankment approximately 42 feet high and 400 feet long. The dam, located approximately 5 miles northwest of Bedford, Virginia, is used for recreation. Springhill Lake Dam is an "intermediate" size - "significant" hazard structure as defined by the Recommended Guidelines for Safety Inspection of Dams. Visual inspection and office analyses indicate deficiencies requiring immediate attention.

Using the Corps of Engineers' screening criteria for initial review of spillway adequacy, the 1/2 Probable Maximum Flood (1/2 PMF) was selected as the spillway design flood (SDF). The SDF was routed through the reservoir and found to overtop the dam by a maximum depth of 1.3 feet with an average critical velocity of 2.8 f.p.s. Total duration of dam overtopping would be approximately 9.4 hours. The dam and reservoir are capable of controlling only 25 percent of the Probable Maximum Flood (PMF), and are therefore considered inadequate. The combination of the instability of the downstream embankment and the inadequate spillway capacity represents a higher potential for dam failure during overtopping of the embankment crest. The area of seepage and sloughing on the downstream embankment around the outlet pipe was the most serious stability condition noted during the field inspection. The dam is assessed as unsafe, emergency.

It is therefore recommended that within two months of the date of notification of the Governor of the Commonwealth of Virginia, the owner engage the services of a professional engineering consultant to analyze the embankment stability and the spillway adequacy. Within six months of the notification of the Governor, the consultant's analyses and recommendations should be completed and the owner should have an agreement with the Commonwealth of Virginia for a reasonable time period in which all remedial measures will be complete. In the interim, an emergency operation and warning plan should be developed and the seepage on the downstream embankment near the outlet pipe should be monitored during periods of heavy runoff.

Since notification to the Governor of the Commonwealth of Virginia of the unsafe emergency assessment, the owner has met with representatives of the State authority and is in the process of mobilizing equipment to lower the pool level in the reservoir and to establish an emergency spillway. It has also been indicated that the owner has retained the services of a professional engineer.

The following items, although important, are not urgent and should be completed as part of the general maintenance of the dam: provide support and a trash screen for the principal spillway pipe, add riprap to the upstream slope and outlet channel, remove trees from the embankment, and install a staff gage in the reservoir.

MICHAEL BAKER, JR., INC.

Michael Baker, III, P.E.
Chairman of the Board and
Chief Executive Officer

COMMONWEALTH OF VIRGINIA
MICHAEL
BAKER III
NO. 3176
CERTIFIED PROFESSIONAL ENGINEER

SUBMITTED: Original signed by JAMES A. WALSH

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Douglas L. Haller
Colonel, Corps of Engineers
District Engineer

Date: SEP 27 1979

NAME OF DAM: SPRINGHILL LAKE DAM

OVERALL VIEW OF DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM: SPRINGHILL LAKE DAM ID# VA 01906

SECTION 1 - PROJECT INFORMATION

1.1 General

1.1.1 Authority: Public Law 92-367, 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of safety inspections of dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guideline for Safety Inspection of Dams. The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Description of Project

1.2.1 Description of Dam and Appurtenances: Springhill Lake Dam (formerly Toms Dam) is an earthfill embankment approximately 42 feet high[1] and 400 feet long. The upstream and downstream slopes (see Photos 1 and 2) are approximately 2.5:1 (horizontal to vertical) and 2:1, respectively. The crest of the dam is approximately 15 feet wide and has a minimum elevation[2] of 830.0 feet Mean Sea Level (M.S.L.) at a point near the center of the embankment. A gravel road is located on the crest of the dam, which varies slightly in elevation along its length.

The principal spillway consists of a vertically standing 6 inch cast-iron pipe located approximately 125 feet from the upstream crest of the dam (see Photo 3). Normal discharges

[1]Measured from the streambed at the downstream toe to the embankment crest.
[2]All elevations are referenced to the elevation of the normal pool as indicated on the Peaks of Otter, Virginia 7.5 minute USGS quadrangle.

from the reservoir enter the outlet pipe through three 3 inch diameter holes cut in the side of the pipe. When the reservoir level rises approximately 1.4 feet above the normal pool elevation of 825.0 feet M.S.L., water enters the open end of the pipe. The pipe outlets at the downstream toe of the dam (see Photo 4) near the midpoint of the embankment.

The emergency spillway, the entrance of which is located near the right[3] abutment, is a 15 inch diameter reinforced concrete pipe (see Photo 5). The outlet of this spillway could not be located during the inspection and is believed to be buried (see Photos 6 and 7 and Plate 1). The spillway is therefore considered non-functional at the present time.

1.2.2 Location: Springhill Lake Dam is located on a small tributary approximately 0.5 mile upstream from the Big Otter River in Bedford County, Virginia. The dam is situated approximately 5 miles northwest of Bedford, Virginia and 2.5 miles southwest of Otterville, Virginia. Access to the dam is obtained via State Route 122 from either Bedford or Otterville.

1.2.3 Size Classification: The height of the dam is 42 feet; the reservoir storage capacity to the crest of the dam, elevation 830.0 feet M.S.L., is 183 acre-feet. The dam is therefore in the "intermediate" size category as defined by the Recommended Guidelines for Safety Inspection of Dams.

1.2.4 Hazard Classification: Two homes are located in low-lying areas approximately 1000 feet and 2000 feet downstream from the dam. Both homes could be subject to extensive flooding in the event of a dam failure by overtopping. Extensive damage to State Routes 640 and 122 and other private roads would be probable. Damage to farmland and crops would also be possible. It is for these reasons that the dam is classified in the "significant" hazard category according to the Recommended Guidelines for Safety Inspection of Dams. The hazard classifications used to categorize dams is a function of location only and has nothing to do with its stability or probability of failure.

[3]Facing downstream.

1.2.5 Ownership: The dam is owned by Mr. John Clark of Bedford, Virginia.

1.2.6 Purpose: The reservoir impounded by the dam is used for recreation.

1.2.7 Design and Construction History: No design records are available. The dam was constructed in the early 1950's by the J.B. Craighead Construction Company.

1.3 Pertinent Data

1.3.1 Drainage Area: The drainage area tributary to the dam is 0.18 square mile.

1.3.2 Discharge at Dam Site: The maximum discharge from the reservoir is unknown.

Principal Spillway:
Pool level at top of dam . . . . . 3 c.f.s.

Emergency Spillway:
Pool level at top of dam . . . . . inoperable

1.3.3 Dam and Reservoir Data: Pertinent data on the dam and reservoir is shown in the following table:

TABLE 1.1 DAM AND RESERVOIR DATA

Item	Elevation feet M.S.L.	Reservoir Area acres	Reservoir Capacity Acre-feet	Reservoir Capacity Watershed inches	Length feet
Top of dam	830.0	16	183	19.1	1800
Emergency spillway invert	826.0	13	125	13.0	1700
Principal spillway crest (normal pool)	825.0	12	112	11.7	1700
Streambed at downstream toe of dam	788±	-	-	-	-

SECTION 2 - ENGINEERING DATA

2.1 Design: No design information was available for use in preparation of this report.

2.2 Construction: The dam was constructed in the early 1950's by the J.B. Craighead Construction Company. Construction records, as-built plan, and inspection logs were not available.

2.3 Operation: No records were available for review.

2.4 Evaluation: No stability analyses or hydrologic and hydraulic data was available for review. No construction records or as-built plans were available to adequately assess the condition of the dam. All evaluations and assessments in this report were based upon field observations and office analyses.

SECTION 3 - VISUAL INSPECTION

3.1 Findings:

3.1.1 General: The field inspection of Springhill Lake Dam (Toms Dam) was conducted on 6 June 1979 during sunny, warm weather. The reservoir level at the time of inspection was at normal pool and ground conditions were dry. The dam and appurtenant structures were in poor condition. The dam is heavily overgrown and numerous seeps, small slumps, and soft areas were observed on the lower left downstream embankment. The outlet for a concrete pipe which comprises the emergency spillway could not be located and is believed to be buried. The principal spillway has no trash rack to prevent debris from clogging the inlet. No means have been provided to drain the reservoir.

Plate 1 is a Field Sketch of the facility which depicts the present conditions. The complete visual inspection check list is included in Appendix III. Following are summaries of the deficiencies noted during the inspection.

3.1.2 Dam: The upstream and downstream slopes at this facility are 2.5:1 and 2:1, respectively. A narrow zone of sloughing extends 14 feet vertically up the center of the downstream slope above the principal spillway outlet (see Plate 1). This zone appears to be directly related to a 1 g.p.m. seep occurring through the embankment and situated at the highest point of the sloughing area. The ground in the vicinity of this zone is extremely soft. The soil was soft enough that a stick could be pushed by hand vertically into the embankment to a depth of 3 feet. The entire downstream embankment left of this slough is wet, soft, and contains numerous small seeps. Approximately three individual seeps also occur just downstream of the left toe of the dam in a very soft area. The combined estimated flow is 8 g.p.m. Two additional minor slumps were observed near the crest of the downstream embankment on the right side (see Plate 1). The upstream slope of the embankment is generally in good condition except that the riprap does not uniformly cover the embankment

(see Photo 1). Much of the riprap is small and washes away easily.

The entire downstream slope is covered with dense brush and large trees (see Photos 2 and 4). A few trees are situated along the waterline near the abutments on the upstream slope (see Overall View of Dam).

3.1.3 Appurtenant Structures: The discharge end of a 15 inch reinforced concrete pipe which serves as the emergency spillway could not be located and is believed to be buried in sediment (see Photo 1). Near the anticipated outlet end an identical pipe was observed, but because of its orientation and elevation it is believed to be the outlet for water collected by a catch basin on the right end of the dam (see Photo 6 and Plate 1).

The discharge channel for the emergency spillway pipe outlet and the catch basin outlet is clogged with debris (see Photo 7). As a result, water has washed out of this discharge channel onto the right downstream abutment of the dam and caused severe erosion (see Photo 8). This erosion has approached the junction of the abutment with the downstream embankment.

The principal spillway inlet (see Photo 3) is not screened and is unprotected from clogging by floating debris. In addition, the cast-iron pipe which comprises the spillway appears to be unsupported and is leaning noticeably upstream. The discharge area for the principal spillway (see Photo 4) is clogged by vegetation. A stilling basin and riprap have not been provided to protect against erosion at the toe of the dam.

3.1.4 Reservoir Area: The reservoir slopes are gentle and generally stable. A few minor slumps have occurred just above the water edge, but pose no major problems.

3.1.5 Downstream Channel: The downstream channel is narrow and heavily overgrown.

3.2 Evaluation: The downstream slope of the embankment from the left abutment to the center of the dam appears unstable considering the numerous seeps, soft ground,

dense vegetation, and lack of an underdrain system. The steepness of the downstream slope (2:1) may also contribute to an inadequate factor of safety for stability. Part of the 8 g.p.m. combined flow from the three seeps in the toe area of the dam might be attributable to normal ground water discharge, but this cannot be substantiated with available information.

The emergency spillway is undersized and presently not functional. Considering the small size and capacity of the principal spillway and its high susceptibility for clogging, the lake could experience abnormally high pool levels.

Under operable conditions, water running through the emergency spillway discharge channel encounters debris and washes over the right downstream abutment causing erosion. With time this erosion could affect the junction of the downstream embankment with the right abutment. The integrity of the principal spillway inlet is questionable because it is leaning noticeably. It is not known whether the spillway was originally installed at this angle or the leaning is an indication of a possible failure. A support structure was not observed for the riser (cast-iron pipe) during the visual inspection.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures: Operation of the dam is an automatic function controlled by the principal spillway. The emergency spillway, a 15 inch concrete pipe at the left abutment, is not presently operable. Water entering the reservoir flows into a 6 inch diameter vertically standing cast-iron pipe acting as a riser. Water enters the pipe through three 3 inch diameter holes at the perimeter of the pipe with invert elevations of 825.0 feet M.S.L. When inflow into the reservoir increases and the reservoir level rises above elevation 826.4 feet M.S.L., water overflows into the open end of the riser (cast-iron pipe). At the time of inspection, the reservoir level was at elevation 825.6 feet M.S.L.

4.2 Maintenance of Dam: Maintenance of the dam is the responsibility of the owner. An inspection or maintenance schedule has not been instituted.

4.3 Maintenance of Operating Facilities: The only control equipment at the dam is the shut-off valve on the discharge end of the principal spillway (see Photo 4). This valve was inoperable when investigated during the visual inspection.

4.4 Warning System: At the present time, there is no warning system or evacuation plan in operation.

4.5 Evaluation: Maintenance of the dam in the past has been inadequate and must be improved. A regular inspection of the dam should also be made by a qualified engineer.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Design: No design data was available for use in preparing this report.

5.2 Hydrologic Records: No rainfall, stream gage, or reservoir stage records are maintained for this dam.

5.3 Flood Experience: No formal flood experience records are maintained for the dam. According to local residents, however, the reservoir periodically rises to a level as high as 2 feet above the normal pool elevation of 825.0 feet M.S.L.

5.4 Flood Potential: Performance of the reservoir by routing the Probable Maximum Flood (PMF) and the 1/2 Probable Maximum Flood (1/2 PMF) is shown in Table 5.1. The flood potential of the reservoir was determined by utilizing the U.S. Army Corps of Engineers' Flood Hydrograph Package, HEC-1 DB, and appropriate unit hydrograph, precipitation, and storage-discharge data. The time of concentration (Tc) and Clark's R used in the analysis were estimated from drainage basin characteristics. The rainfall applied to the unit hydrograph was obtained from the U.S. Weather Bureau (Reference 5, Appendix V). Rainfall losses were estimated at an initial loss of 1.0 inch and a constant loss thereafter of 0.05 inch per hour.

5.5 Reservoir Regulation: Pertinent dam and reservoir data is shown in Table 1.1, paragraph 1.3.3.

Regulation of flow from Springhill Lake Dam is automatic. Normal inflows to the reservoir are discharged through the principal spillway as described in Section 4.1. No means is currently available to discharge excessive flood flows from the reservoir. Therefore, as the reservoir level rises above elevation 830.0 feet M.S.L., water will begin to flow over the crest of the dam.

Reservoir area and storage capacity were determined by use of the 7.5 Minute USGS quadrangle for Peaks of Otter, Virginia. Outlet discharge capacity was computed neglecting flow through the emergency overflow pipe which was considered inoperable. Flood routings were determined with the initial reservoir level at normal pool.

5.6 Overtopping Potential: The probable rise in reservoir and other pertinent information on reservoir performance for the 1/2 PMF and PMF hydrographs are shown in the following table:

NAME OF DAM: SPRINGHILL LAKE DAM

TABLE 5.1 RESERVOIR PERFORMANCE

Item	Normal	Hydrographs 1/2 PMF	Hydrographs PMF(a)
Peak flow, c.f.s.			
Inflow	-	1575	3150
Outflow	-	830	2680
Peak elev., ft. M.S.L.	825.0(b)	831.3	832.4
Non-overflow section (elev. 830.0 feet M.S.L.)			
Depth of flow, ft.	-	1.3	2.4
Average velocity, f.p.s.	-	2.8	3.6
Duration of overtopping, hrs.	-	9.4	10.4
Tailwater elev., ft. M.S.L. (c)	786.4	-	-

(a) The PMF is an estimate of flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in a region.
(b) All elevations are based on the assumed elevation of 825.0 feet M.S.L. for normal pool.
(c) Tailwater at time of inspection.

5.7 Reservoir Emptying Potential: No facilities are available for drawdown of the reservoir.

5.8 Evaluation: Springhill Lake Dam is an "intermediate" size - "significant" hazard dam requiring evaluation for a spillway design flood (SDF) equal to the 1/2 PMF. The 1/2 PMF was routed through the reservoir and found to overtop the dam by a maximum depth of approximately 1.3 feet with an average critical velocity of 2.8 f.p.s. Total duration of dam overtopping would be approximately 9.4 hours. The spillway is capable of controlling only 25 percent of the PMF.

Conclusions pertain to present day conditions and the effect of future development on the hydrology has not been considered.

SECTION 6 - DAM STABILITY

6.1 Foundation and Abutments: No information is available concerning the specific nature of the foundation and abutments. Bedrock outcrops should consist of Precambrian igneous and metamorphic rock of the Virginia Blue Ridge complex.

6.2 Stability Analysis

6.2.1 Visual Observations: Sloughing above the principal spillway outlet has occurred on the downstream embankment slope due to seepage through the dam. This zone is narrow and extends to a point 14 feet vertically above the spillway. It appears to be directly related to the 1 g.p.m. seep which is located at the top of the unstable area. The embankment in the sloughed area is extremely soft; during the inspection, a stick was readily pushed by hand into the embankment a vertical distance of approximately 3 feet. In addition, the entire downstream embankment slope left of this slough is wet, soft, and contains numerous small seeps. Immediately downstream from the left toe of the dam are 3 seeps located in a very soft area. The total estimated seepage rate is 8 g.p.m.

There are also 2 smaller slumps near the crest of the right side of the downstream embankment.

The upstream embankment appears to be generally in good condition except for the observation that the riprap does not uniformly cover the embankment. Because much of the riprap is undersized, it readily erodes and washes downstream.

6.2.2 Design and Construction Data: Design and/or construction data was unavailable.

6.2.3 Operating Records: Operating records have not been kept for this facility. The pool level is reported to have risen above the open end of the principal spillway inlet during the Spring of 1979.

6.2.4 Post-Construction Changes: There have been no known significant post-construction changes.

6.2.5 Seismic Stability: Springhill Lake Dam is located in Seismic Zone 2 and is considered to have no hazard from earthquakes, according to the Recommended Guidelines for Safety Inspection of Dams, provided static stability conditions are satisfactory and conventional safety margins exist.

6.3 Evaluation: The downstream embankment slope is of marginal stability. Signs of instability noted during visual inspection were the seeps, sloughing, and soft ground. Further detailed analyses are necessary to adequately evaluate the stability of the dam.

Because the slopes show signs of instability and since foundation and embankment conditions are unknown, it is recommended that stability analyses be made.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: Several conditions discovered during the field investigation and office analyses indicate deficiences requring immediate attention. The most urgent of these items is the clear seepage areas observed on the downstream slope of the embankment. A narrow zone of sloughing, extending approximately 14 feet above the outlet pipe, had a clear seepage rate of approximately 1 g.p.m. The embankment soil in this area was very soft and wet. The soil was so soft that a stick could be pushed by hand vertically into the embankment to a depth of 3 feet. The entire downstream slope to the left of this area is also soft and wet. The total clear seepage from this area was estimated at 8 g.p.m. at the toe. Although no evidence of piping was observed during the field inspection, the amount of seepage and large saturated portions of the embankment indicate a potential for piping and further sloughing of the embankment material.

Using the Corps of Engineers' screening for initial review of spillway adequacy, the 1/2 PMF was selected as the SDF for the "intermediate" size - "significant" hazard classification of Springhill Lake Dam. It has been determined that the dam would be overtopped by the SDF by a maximum depth of 1.3 feet with an average critical velocity of 2.8 f.p.s. and would remain above the top of dam for 9.4 hours. The dam and reservoir are capable of controlling only 25 percent of the PMF, and therefore the spillway capacity is considered inadequate. The combination of the instability of the downstream embankment and the inadequate spillway capacity represents a higher potential for dam failure during overtopping of the embankment crest. The dam is assessed as unsafe, emergency.

The outlet of the 15 inch reinforced concrete pipe acting as an emergency spillway on the right side of the dam was not located during the inspection. In its condition at the time of inspection, the pipe would not function properly, if at all. The probability of the dam being overtopped would be decreased from that shown in Section 5 if this pipe was functional.

The discharge channel from a pipe draining a catch basin on the right side of the dam was severely blocked with debris. This debris causes water to leave the channel and flow over the right abutment of the dam. The abutment is highly eroded. The erosion is proceeding toward the junction with the embankment. This condition,

as well as increasing potential for dam overtopping, could also seriously affect the stability of the right abutment. The downstream slope of the dam is heavily vegetated which made visual inspection difficult and could obscure other possible problems. The inability to dewater the reservoir prohibits remedial repair of the downstream toe.

7.2 Recommended Remedial Measures: It is recommended that within two months of the date of notification of the Governor of the Commonwealth of Virginia, that the owner engage the services of a professional engineering consultant to:

1) Determine the stability of the upstream and downstream slopes, especially in the area of sloughing and seepage at the center of the downstream embankment near the outlet pipe.

2) Determine by more sophisticated methods and procedures the adequacy of the spillways. The study should include a more detailed study of the downstream floodplain and of the spillway design flood appropriate to this dam. Remedial measures to be considered include modification of the dam, spillway, floodplain, and/or any other method of eliminating the danger imposed by the project.

Within six months of the notification of the Governor, the consultant's report of appropriate remedial mitigating measures should have been completed and the owner should have an agreement with the Commonwealth of Virginia for a reasonable time frame in which all remedial measures will be complete.

The 15 inch reinforce concrete pipe acting as an emergency spillway should be immediately returned to operating condition.

Until corrective measures are completed the dam should be checked during periods of heavy runoff. Monitoring of the flow rate and turbidity is recommended. If evidence of piping of embankment material, sliding of the embankment, or if dam overtopping is imminent warning should be issued to the downstream inhabitants.

In the interim, an emergency operation and warning plan should be promptly developed. It is recommended that a formal emergency procedure be prepared, prominently displayed, and furnished to all operating personnel. This should include:

1) How to operate the dam during an emergency.

2) Who to notify, including public officials, in case evacuation from the downstream area is necessary.

3) Procedures to evaluate inflow during periods of emergency operation.

The following items should be accomplished as part of the general maintenance of the dam. These include:

1) Provide structural supports for the vertical pipe of the principal spillway.

2) Install a trash screen on the principal spillway to prevent blockage.

3) Add additional riprap to the upstream embankment slope.

4) Provide riprap protection at the discharge end of the outlet pipe for the principal spillway.

5) Remove trees and brush from the embankment.

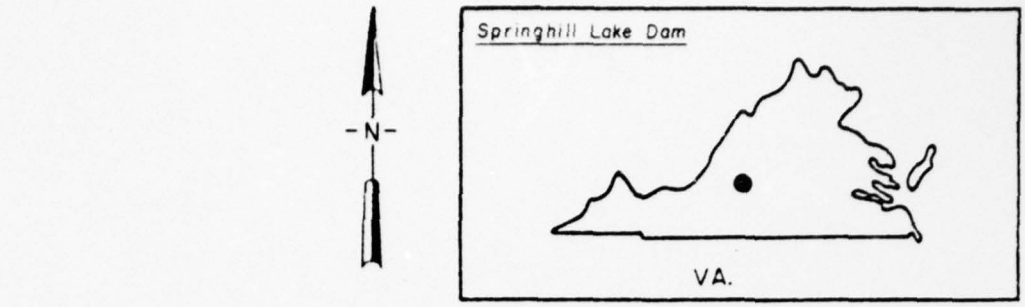
6) Install staff gage to monitor reservoir levels above normal pool.

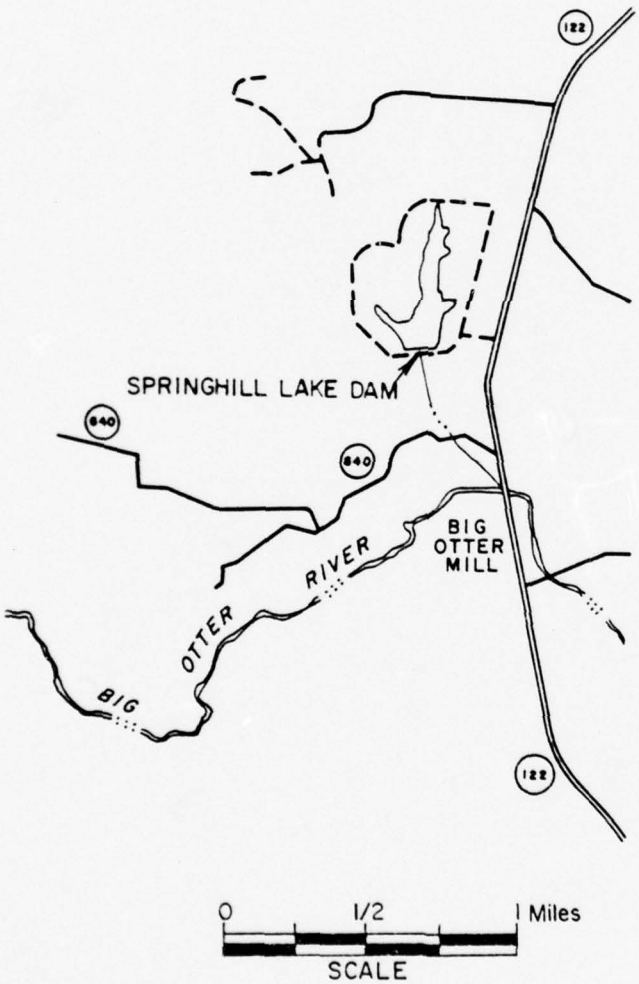
APPENDIX I

PLATES

CONTENTS

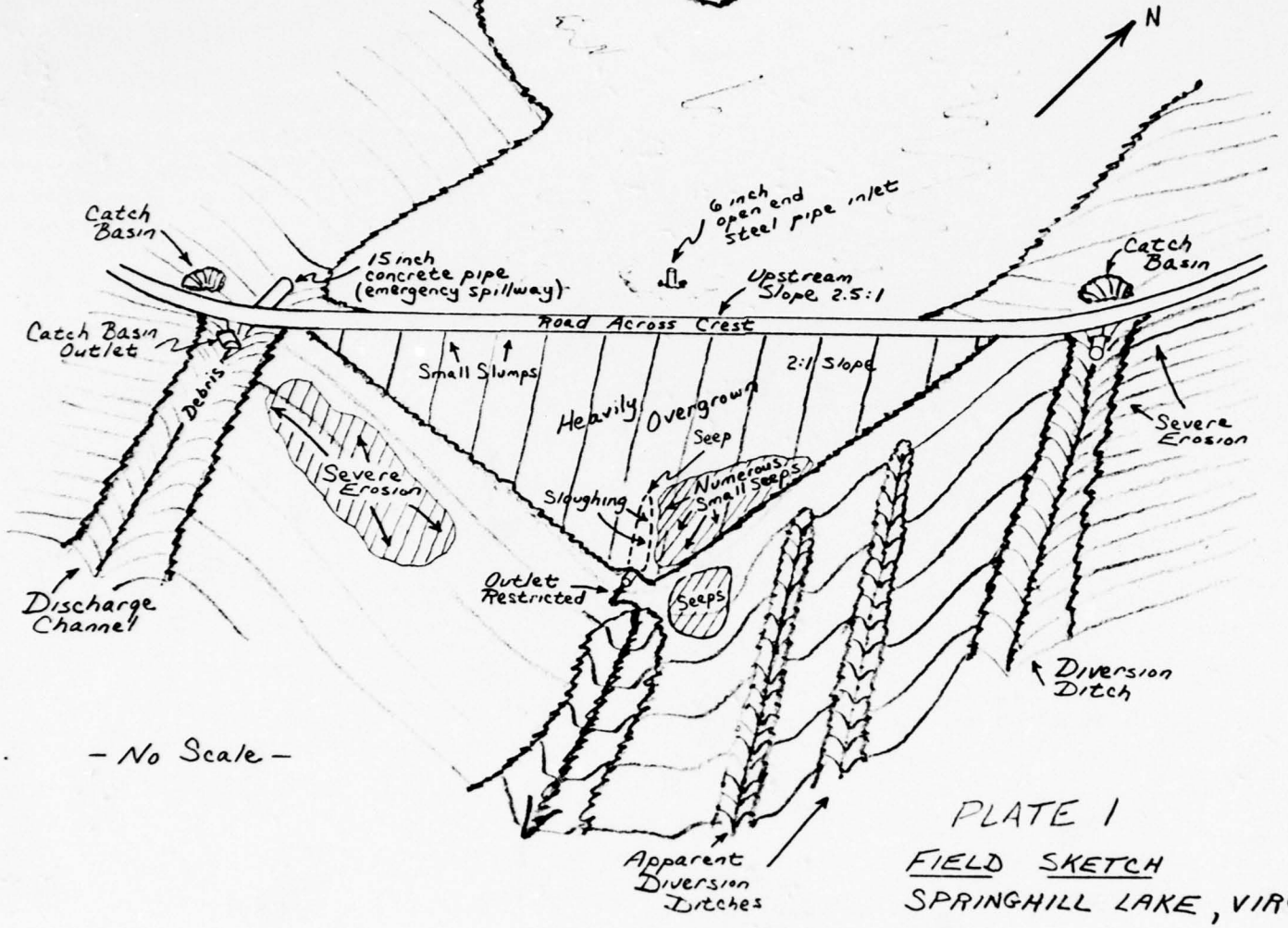
NAME OF DAM: SPRINGHILL LAKE DAM





LOCATION PLAN

SPRINGHILL LAKE DAM



– No Scale –

PLATE 1

FIELD SKETCH

SPRINGHILL LAKE, VIRGINIA

Michael Baker, Jr., Inc.

6 June 1979

SPRINGHILL LAKE
TOP OF DAM PROFILE
AND TYPICAL CROSS SECTION
SCALE: AS SHOWN

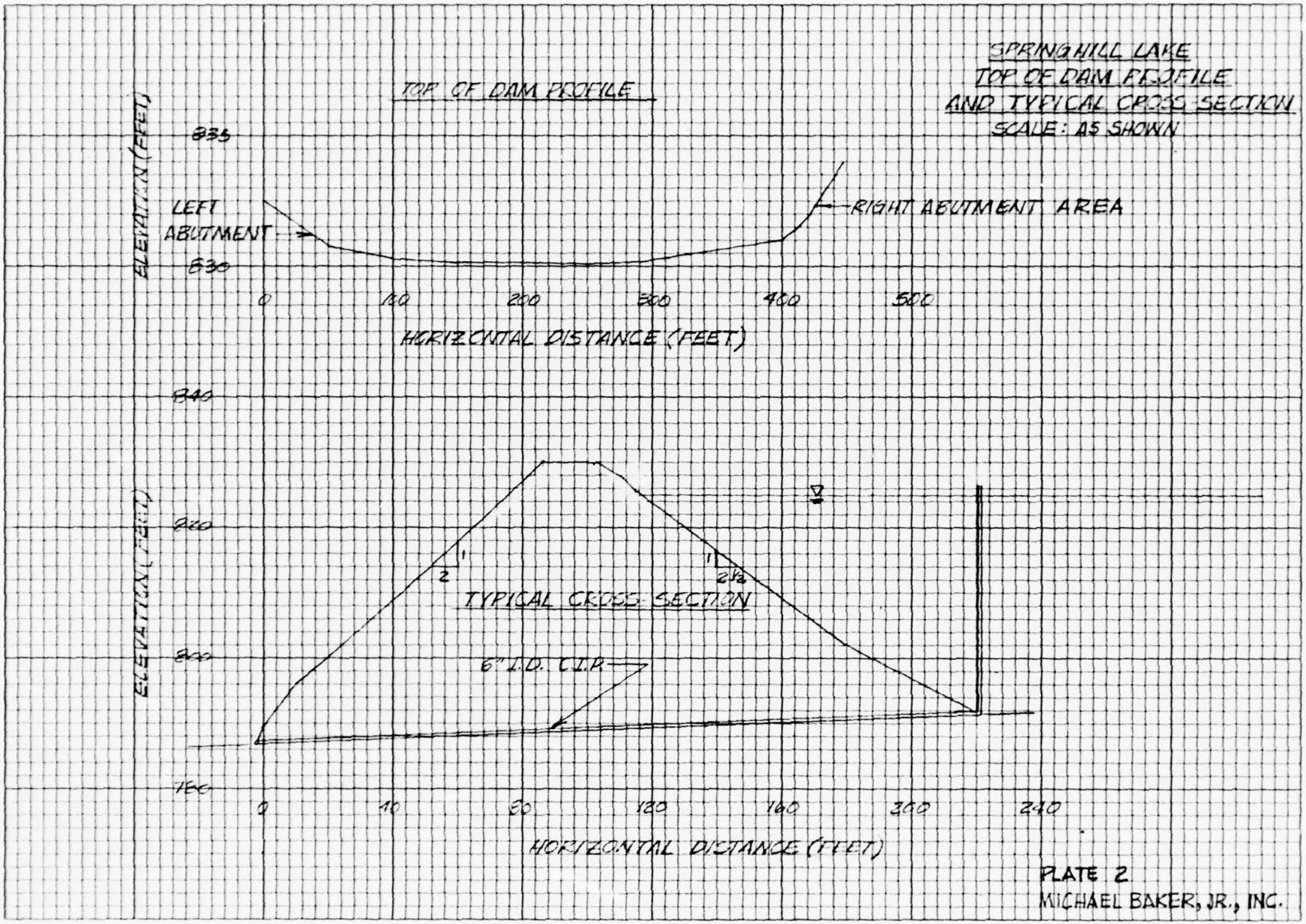


PLATE 2
MICHAEL BAKER, JR., INC.

APPENDIX II

PHOTOGRAPHS

CONTENTS

Note: Photographs were taken on 6 June 1979.

NAME OF DAM: SPRINGHILL LAKE DAM

SPRINGHILL LAKE DAM

PHOTO 1. Upstream Embankment with Riprap

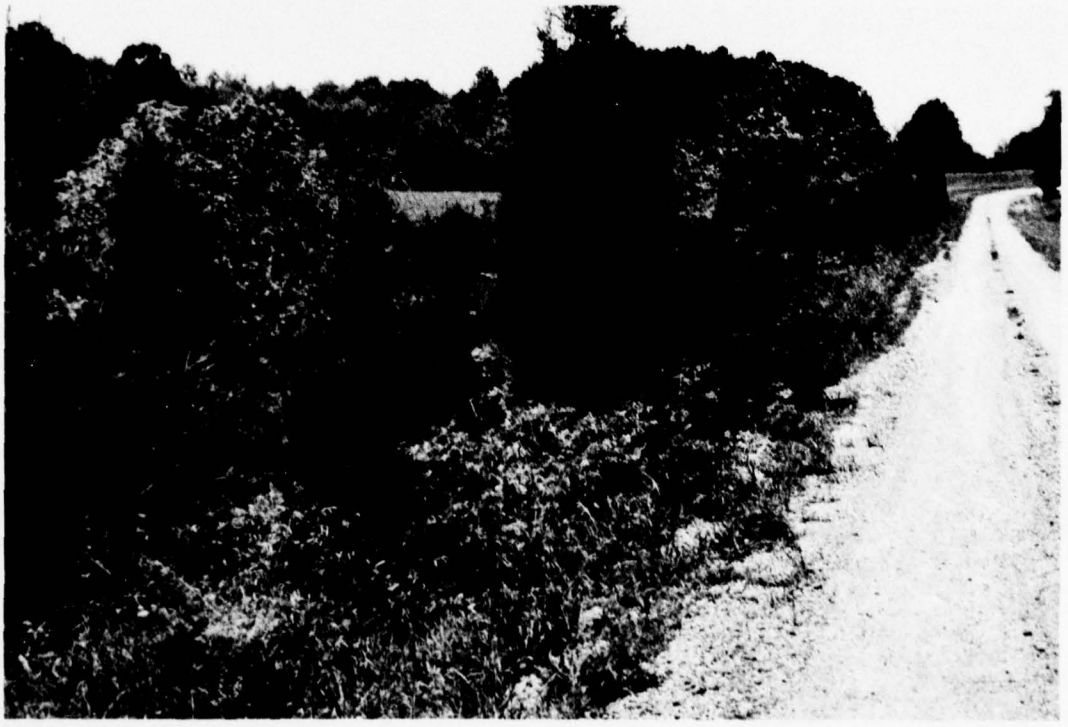


PHOTO 2. Gravel Road Across Crest and Downstream Embankment

SPRINGHILL LAKE DAM

PHOTO 3. Principal Spillway Inlet (six inch steel pipe)

PHOTO 4. Principal Spillway Outlet

PHOTO 5. Emergency Spillway Inlet

PHOTO 6. Catch Basin Outlet at Right Downstream End of Dam

PHOTO 7. Discharge Channel of Emergency Spillway

PHOTO 8. Erosion on Right Downstream Abutment

APPENDIX III

CHECK LIST - VISUAL INSPECTION

Check List
Visual Inspection
Phase 1

Name of Dam Springhill Lake Dam (Toms Dam) County Bedford State Virginia Coordinates Lat. 3723.8 Long. 7930.5

Date of Inspection 6 June 1979 Weather Sunny Temperature 80°F.

Pool Elevation at Time of Inspection 825.6 ft. M.S.L. Tailwater at Time of Inspection 786.4 ft. M.S.L.

Inspection Personnel:

Michael Baker, Jr., Inc.:

T. W. Smith
R. E. Holderbaum
D. W. Hupe

State Water Control Board:

H. M. Gildea

Soil Conservation Service:

A. B. Guthrie, Jr.

D. W. Hupe Recorder

EMBANKMENT

Name of Dam: SPRINGHILL LAKE DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Successive small slumps on the downstream embankment extent directly up the embankment from the outlet pipe. This area is extremely soft and is caused by a seep through the dam. A few small slumps exist on the upper downstream right embankment. Slight erosion of the top slopes of the embankment has occurred. The right downstream abutment slope is highly eroded. The top of the slope of the left downstream abutment area is highly eroded.	
VERTICAL AND HORIZONTAL ALIGNEMNT OF THE CREST	The vertical alignment varies approximately 1 ft. along the length of the crest. No significant deviations of the horizontal alignment were observed.	
RIPRAP FAILURES	Riprap is not present on the downstream side of the dam at the junction of the embankments and abutments, around the outlet pipe, or in the discharge channel. Part of the upstream face of the dam is riprapped with quartzite. The riprap is not holding to the steep slope. The top 4 ft. of the upstream embankment is not riprapped.	Riprap is needed around the outlet pipe. Larger riprap is needed on the upstream face of the dam.

EMBANKMENT

Name of Dam: SPRINGHILL LAKE DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VEGETATIVE COVER	The downstream embankment is densely overgrown by high brush and trees.	The trees should be removed.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	The left downstream junction area is not eroded. Runoff is slightly restricted by dense vegetation and uneven ground. The right downstream junction has been eroded slightly by water washing down the abutment slope from the area of the emergency spillway channel and the catch basin outlet. The upstream embankment and abutment junctions are slightly eroded.	The ditch meant to handle drainage from the emergency spillway and catch basin on the right end of the dam must be cleaned out and improved to prevent water from washing down the embankment and abutment junction.
ANY NOTICEABLE SEEPAGE	The most significant seepage occurs 14 ft. directly above the outlet pipe. The flow is iron-stained and less than 1 g.p.m. and has initiated successive small slumps. The ground is extremely soft (able to push a stick into the ground by hand 3 ft. deep). Approximately three individual seeps occur below the left downstream toe of the dam in a very soft area covering approximately 400 $ft.^2$ (total discharge estimated at 8 g.p.m.). The left, lower downstream embankment has numerous small seeps and is soft.	
STAFF GAGE AND RECORDER	None present	A staff gage should be installed.
DRAINS	None observed	

OUTLET WORKS

Name of Dam: SPRINGHILL LAKE DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
OUTLET CONDUIT	The outlet conduit is a 6 in. dia. C.I.P.	The outlet conduit was inaccessible.
INTAKE STRUCTURE	The intake consists of a vertical, open-ended, 6 in. dia. steel pipe with 3 holes which serve as the normal intake points. The holes are approximately 2-3 in. in dia. (7 in. below pool level at the time of inspection).	The small intake holes could easily become clogged.
OUTLET STRUCTURE	The outlet consists of the 6 in. dia. steel pipe with a valve at the end. The valve could not be turned and was badly rusted. The outlet pipe is slightly undercut.	
OUTLET CHANNEL	The outlet channel is very restricted and overgrown in the immediate area of the outlet. The discharge water must make a very sharp left turn until it flows into a larger, less restricted channel.	
EMERGENCY GATE	The valve on the outlet pipe appeared to be fully open. There is no means to drawdown the lake below normal pools.	

UNGATED SPILLWAY

Name of Dam: SPRINGHILL LAKE DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	None	
APPROACH CHANNEL	The emergency spillway consists of a 15 in. dia. concrete pipe which extends through the right abutment area. The upstream end is unrestricted.	
DISCHARGE CHANNEL	The emergency spillway pipe outlet could not be located. It is believed that it is covered with sediment and clogged.	The outlets should be cleaned and the discharge channel should be cleared of debris.
	A 15 in. dia. concrete pipe, which appears to drain the catch basin located on the upstream side of the road that crosses the crest of the dam, discharges into the spillway discharge channel. The end of this pipe is almost completely buried and clogged. The discharge channel is congested with pieces of concrete and is severely eroded.	The discharge channel should be riprapped to stop erosion.
BRIDGE AND PIERS	None	

INSTRUMENTATION

Name of Dam: SPRINGHILL LAKE DAM

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	No permanent markers were found.	
OBSERVATION WELLS	None observed	
WEIRS	None observed	
PIEZOMETERS	None observed	
OTHER		

RESERVOIR

Name of Dam: SPRINGHILL LAKE DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Minor slumps have occured in the reservoir slopes just above the waterline. Generally, the surrounding slopes are gentle.	
SEDIMENTATION	Sedimentation does not appear to be significant.	

DOWNSTREAM CHANNEL

Name of Dam: SPRINGHILL LAKE DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The downstream channel is generally narrow and overgrown.	
SLOPES	The slopes surrounding the downstream channel are steep for a distance of approximately 750 ft. downstream of the dam.	
APPROXIMATE NO. OF HOMES AND POPULATION	One home is located approximately 1000 ft. downstream from the dam and another home approximately 2000 ft. downstream along Buffalo Creek. Population is estimated at approximately 8.	

APPENDIX IV

CHECK LIST - ENGINEERING DATA

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

Name of Dam: SPRINGHILL LAKE DAM

ITEM	REMARKS
PLAN OF DAM	A Plan of Dam was not available. A Field Sketch is included in this report as Plate 1.
REGIONAL VICINITY MAP	The vicinity map is presented in this report as the Location Plan.
CONSTRUCTION HISTORY	Some initial design assistance was provided by the SCS. Construction was done by J. B. Craighead, Moneta, Virginia in the early 1950's.
TYPICAL SECTIONS OF DAM	A typical section of the dam has been compiled and is included in this report as Plate 2.
HYDROLOGIC/HYDRAULIC DATA	None were available for review.
OUTLETS - PLAN,	
DETAILS,	
CONSTRAINTS, and DISCHARGE RATINGS	None available
RAINFALL/RESERVOIR RECORDS	No records are maintained.

Name of Dam: SPRINGHILL LAKE DAM

ITEM	REMARKS
DESIGN REPORTS	None available
GEOLOGY REPORTS	None available
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available
POST-CONSTRUCTION SURVEYS OF DAM	No known post-construction surveys were found.
BORROW SOURCES	The borrow sources are unknown.

Name of Dam: SPRINGHILL LAKE DAM

ITEM	REMARKS
MONITORING SYSTEMS	No monitoring systems have been provided.
MODIFICATIONS	None
HIGH POOL RECORDS	The pool level rose above the top of the outlet pipe during the spring of 1979.
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None available
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	No prior accidents or failure of the dam have been noted.
MAINTENANCE OPERATION RECORDS	None

Name of Dam: SPRINGHILL LAKE DAM

ITEM	REMARKS
SPILLWAY PLAN, SECTIONS, and DETAILS	Not available. Plate 1 illustrates the general configuration and existing condition of the emergency spillway.
OPERATING EQUIPMENT PLANS & DETAILS	Not Applicable

APPENDIX V

GENERAL REFERENCES

GENERAL REFERENCES

1. Bureau of Reclamation, U.S. Department of the Interior, Design of Small Dams, A Water Resources Technical Publication, Revised Reprint, 1977.

2. Chow, Ven Te, Handbook of Applied Hydrology, McGraw - Hill Book Company, New York, 1964.

3. Chow, Ven Te, Open Channel Hydraulics, McGraw - Hill Book Company, New York, First Edition, 1959.

4. Commonwealth of Virginia, "Geologic Map of Virginia," Department of Construction and Economic Development, and Division of Mineral Resources, 1963.

5. HR 33, "Seasonal Variations of Probable Maximum Precipitation, East of the 105th Meridian for Areas 10 to 1000 Square Miles and Durations of 6 to 48 Hours," (1956).

6. King, Horace Williams and Brater, Ernest F., Handbook of Hydraulics, Fifth Edition, McGraw - Hill Book Company, New York, 1963.

7. Soil Conservation Service, "National Engineering Handbook - Section 4, Hydrology," U.S. Department of Agriculture, 1964.

8. Soil Conservation Service, "National Engineering Handbook - Section 5, Hydraulics," U.S. Department of Agriculture.

9. U.S. Army, Hydrologic Engineering Center, "Flood Hydrograph Package (HEC-1), Dam Safety Investigations, Users Manual," Corps of Engineers, Davis, California, September 1978.

10. U.S. Army, Hydrologic Engineering Center, "HEC-2 Water Surface Profiles, Users Manual," Corps of Engineers, Davis, California, October 1973.

11. U.S. Army, "Inventory of United States Dams," Corps of Engineers, 9 September 1978.

12. U.S. Army, Office of the Chief of Engineers, "Appendix D, Recommended Guidelines for Safety Inspection of Dams," National Program of Inspection of Dams, Volume 1, Corps of Engineers, Washington, D.C., May 1975.

13. U.S. Army, Office of the Chief of Engineers, Engineering Circular EC-1110-2-163 (Draft Engineering Manual), "Spillway and Freeboard Requirements for Dams, Appendix C, Hydrometeorological Criteria and Hyetograph Estimates," (August 1975).

14. U.S. Army, Office of the Chief of Engineers, Engineering Circular EC-1110-2-188, "Engineering and Design, National Program of Inspection of Non-Federal Dams," Corps of Engineers, Washington, D.C., 30 December 1977.

15. U.S. Army, Office of the Chief of Engineers, Engineer Technical Letter No. ETL 1110-2-234, "Engineering and Design, National Program of Inspection of Non-Federal Dams, Review of Spillway Adequacy," Corps of Engineers, Washington, D.C., 10 May 1978.

16. U.S. Department of Commerce, "Technical Paper No. 40, Rainfall Frequency Atlas of the United States for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years," Weather Bureau, Washington, D.C., May 1961.